

REVEAL: Software Documentation and Platform Migration

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USRP Interns – Summer 2008



Outline

- Background
- Internship Objectives
- Project Foundation
- Platform Migration
- Field Test
- Next Steps
- Project Status



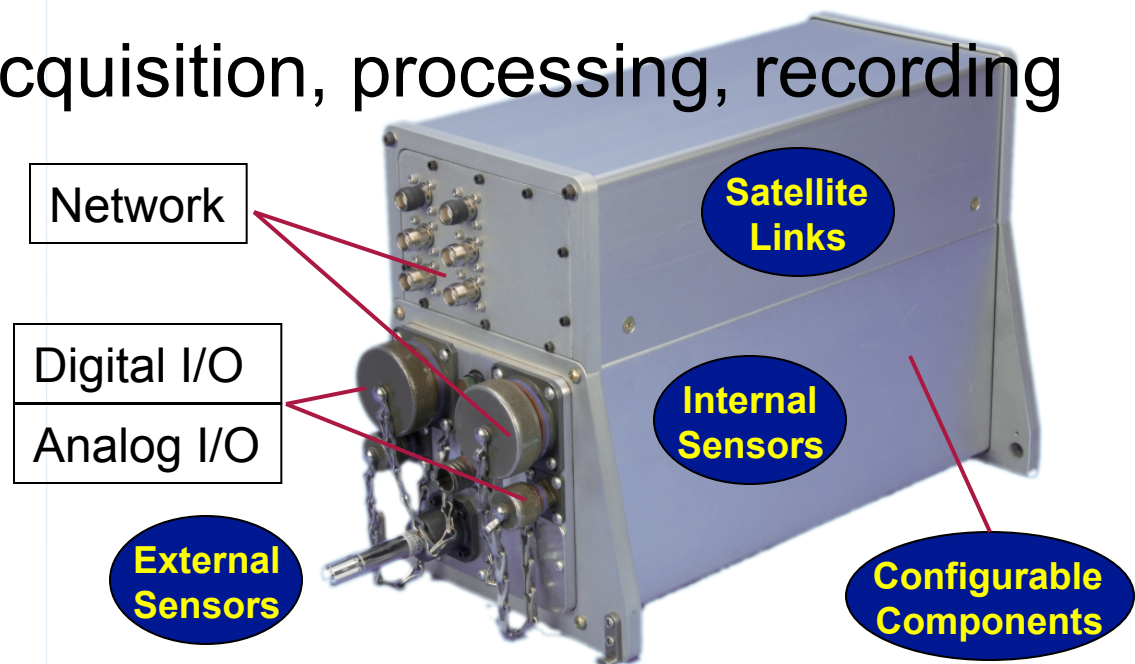
REVEAL

- Research Environment for Vehicle-Embedded Analysis on Linux
- Implemented on MontaVista Linux
- “Data acquisition and distribution system”
- Primarily used in aircraft



Suborbital Telepresence

- Hardware platform for REVEAL
- PC/104 Form Factor
- Configurable acquisition, processing, recording



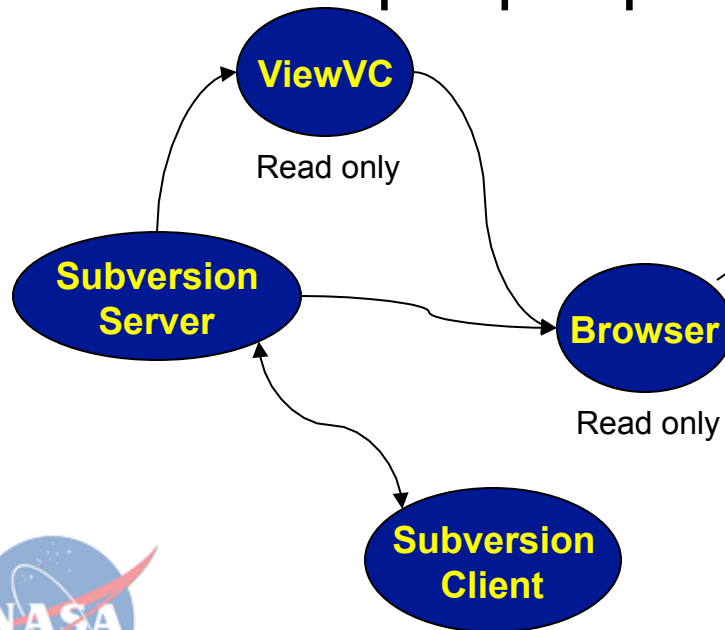
Internship Objectives

- Grow REVEAL's support for multiple developers
 - modern version control system
 - modern software documentation
- Verify implementation flexibility
 - implement on different CPUs
 - demonstrate end-to-end functionality



Project Foundation: Subversion

- Version Control Software
- Motivation
 - Multiple people working with same files



Revision 80: /

- [DailyReports/](#)
- [ERAU_REVEAL_XML/](#)
- [FinalDraftVeibell.txt](#)
- [FinalOutline.txt](#)
- [NTPD_Setup](#)
- [REVEAL_MAKENOTES](#)
- [Reveal_Setup](#)
- [ToDo.txt](#)
- [USRP_Report.odt](#)
- [WeeklyReports/](#)
- [doxygen_checklist](#)
- [doxygen_manual-1.5.6.pdf](#)
- [mod_authz_svn_notes.txt](#)
- [piccolo_comms.pdf](#)
- [piccolo_notes](#)
- [svn-book.pdf](#)
- [svn_authentication_notes.txt](#)
- [xmlperl/](#)
- [xmltracer/](#)

Powered by [Subversion](#) version 1.4.6 (r28521).



ViewVC




















Browser based repository

Index of /

Files shown: **14**

Directory revision: [77](#) (of [77](#))

Sticky Revision:

File ^	Rev.	Age	Author	Last log entry
 DailyReports/	77	17 hours	erau	Added 31JUL08
 ERAU_REVEAL_XML/	68	4 days	erau	Added 25JUL08 and XML files used with ERAU's Summer 2008 mission
 WeeklyReports/	71	44 hours	erau	Added 30JUL08
 xmlperl/	62	10 days	erau	Added Perl verison of xml graphing
 xmltracer/	68	4 days	erau	Added 25JUL08 and XML files used with ERAU's Summer 2008 mission
 FinalDraftVeibell.txt	76	17 hours	erau	Revised
 FinalOutline.txt	60	11 days	erau	Update Outline
 NTPD_Setup	48	3 weeks	erau	Added 09JUL08
 REVEAL_MAKENOTES	1	6 weeks	erau	Initial Import
 Reveal_Setup	54	2 weeks	erau	Added 16JUL08, updated Reveal_Setup
 ToDo.txt	74	41 hours	erau	Updated USRP_Report
 USRP_Report.odt	75	17 hours	erau	Updated USRP_Report
 doxygen_checklist	24	5 weeks	erau	Uploaded doxygen_checklist - steps for adding documentation to REVEAL
 doxygen_manual-1.5.6.pdf	22	6 weeks	erau	Added 19JUN08
 mod_authz_svn_notes.txt	9	6 weeks	erau	Added more notes
 piccolo_comms.pdf	49	3 weeks	erau	Added piccolo communications guide
 piccolo_notes	52	2 weeks	erau	Added 14JUL08, updated Reveal_Setup, piccolo_notes
 svn-book.pdf	1	6 weeks	erau	Initial Import
 svn_authentication_notes.txt	9	6 weeks	erau	Added more notes

[Site Admin](#)

Powered by [ViewVC 1.0.5](#)

ViewVC

Highlighted differences

**revision 33, Thu Jul 3 18:55:04 2008
UTC**

**revision 36, Tue Jul 8 22:56:50 2008
UTC**

#	Line 3	Line 3
3	CC = gcc	CC = gcc
4	CFLAGS = -I\$(IXML) -I\$(INOVAS) -I\$(IARINC) -I\$(IDSCUD) -D\$(OS)	CFLAGS = -I\$(IXML) -I\$(INOVAS) -I\$(IARINC) -I\$(IDSCUD) -D\$(OS)
5		
6	REVEAL = /Users/mjm/Reveal	REVEAL = ..
7	LDADS = \$(REVEAL)/Revealv1.1a	OBJ = \$(REVEAL)/lib
8	OBJ = \$(LDADS)/LIB	BIN = \$(REVEAL)/bin
	BIN = \$(LDADS)/BIN	
9	IXML = /usr/include/libxml2	IXML = /usr/include/libxml2
10	OS = OSX	OS = OSX
11		THIRDPARTY = \$(REVEAL)/ThirdParty
12		
13	LD_LIBRARY_PATH=\$LDADS/BIN:\$LDADS/LIB:/usr/lib	# LD_LIBRARY_PATH=\$LDADS/BIN:\$LDADS/LIB:/usr/lib



Doxygen

- Visual Interactive Code Documentation
- Motivation
 - Easy to find and interpret code
 - Parses files, functions, variables, definitions
 - Useful comment structure



```

*****
* Validates ARINC-429 parity
*****
*
* @section func_sec FUNCTIONAL DESCRIPTION:
* The Condor card has already checked parity and set a
* bit in the 32-bit parameter word to let us know, we just look at the bit.
*
* @section revhist_sec REVISION HISTORY:
* Date      By      Description<br>
* -----<br>
* 11/24/04 Carl Sorenson    Created<br>
* 01/31/08 Carl Sorenson    From 2 to 4 channels
*
* @section notes_sec NOTES:
* If the channel is in "raw mode" parity is not checked by card or us.
*
*****
int checkParity(int chan, uint32_t word)
/** @return TRUE if it checks valid, otherwise false */
/** @param chan the channel index */
/** @param word the 32-bit ARINC-429 parameter word, via the Condor API */
{
    int okay = FALSE;      // return code
    uint32_t ptest;        // parity test value

    switch(chan)
    {
        case ARINC_CHAN0: ptest = ARINC_CHAN0_PARITY; break;
        case ARINC_CHAN1: ptest = ARINC_CHAN1_PARITY; break;
        case ARINC_CHAN2: ptest = ARINC_CHAN2_PARITY; break;
        case ARINC_CHAN3: ptest = ARINC_CHAN3_PARITY; break;
        default: jobMsg(LOG_BYE,"checkParity: unknown channel: %i\n",chan);
    }

    if (working) switch(ptest)
    {
        case AR_ODD: if (!(word & ARINC_PARITY_BIT)) okay = TRUE; break;
        case AR_EVEN: if (word & ARINC_PARITY_BIT) okay = TRUE; break;
        case AR_RAW: okay = TRUE; break;
        default: jobMsg(LOG_BYE,"checkParity: internal error: %i\n",ptest);
    }

    return(okay);
}

```

```

int checkParity (int      chan,
                 uint32_t word
                 )

```

FUNCTIONAL DESCRIPTION:

The Condor card has already checked parity and set a bit in the 32-bit parameter word to let us know, we just look at the bit.

REVISION HISTORY:

Date By Description

 11/24/04 Carl Sorenson Created
 01/31/08 Carl Sorenson From 2 to 4 channels

NOTES:

If the channel is in "raw mode" parity is not checked by card or us.

Returns:

TRUE if it checks valid, otherwise false

Parameters:

chan the channel index
 word the 32-bit ARINC-429 parameter word, via the Condor API

Definition at line 229 of file [arinc_driver.c](#).

```

00233 {
00234     int okay = FALSE;      // return code
00235     uint32_t ptest;        // parity test value
00236
00237     switch(chan)
00238     {
00239         case ARINC_CHAN0: ptest = ARINC_CHAN0_PARITY; break;
00240         case ARINC_CHAN1: ptest = ARINC_CHAN1_PARITY; break;
00241         case ARINC_CHAN2: ptest = ARINC_CHAN2_PARITY; break;
00242         case ARINC_CHAN3: ptest = ARINC_CHAN3_PARITY; break;
00243         default: jobMsg(LOG_BYE,"checkParity: unknown channel: %i\n",chan);
00244     }
00245
00246     if (working) switch(ptest)
00247     {
00248         case AR_ODD: if (!(word & ARINC_PARITY_BIT)) okay = TRUE; break;
00249         case AR_EVEN: if (word & ARINC_PARITY_BIT) okay = TRUE; break;
00250         case AR_RAW: okay = TRUE; break;
00251         default: jobMsg(LOG_BYE,"checkParity: internal error: %i\n",ptest);
00252     }
00253
00254     return(okay);
00255 }

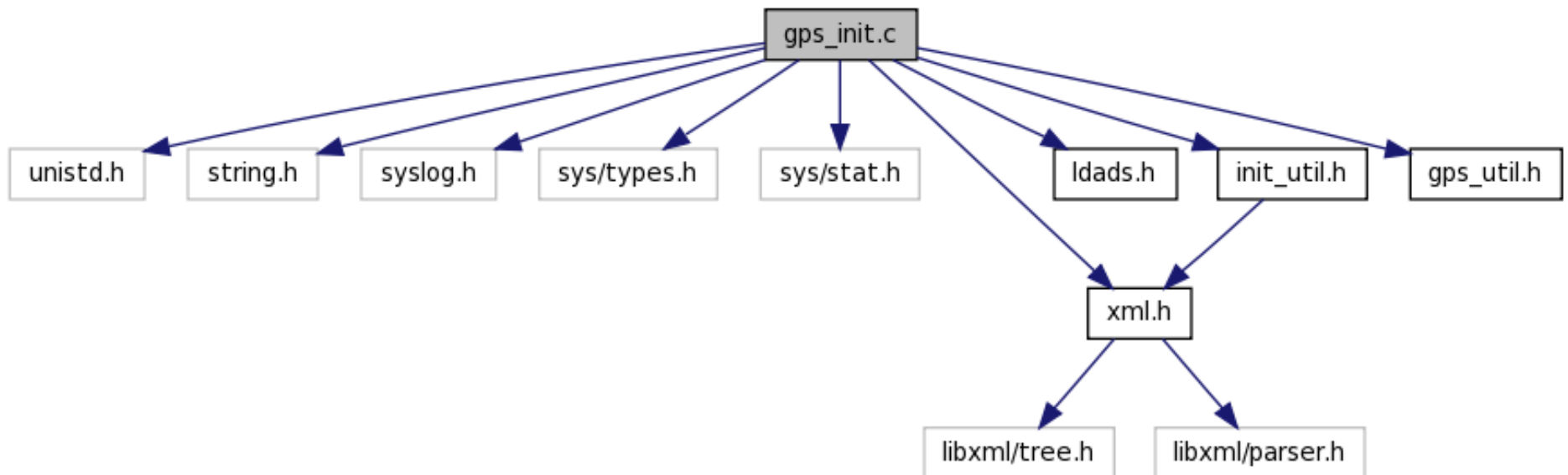
```

Here is the call graph for this function:



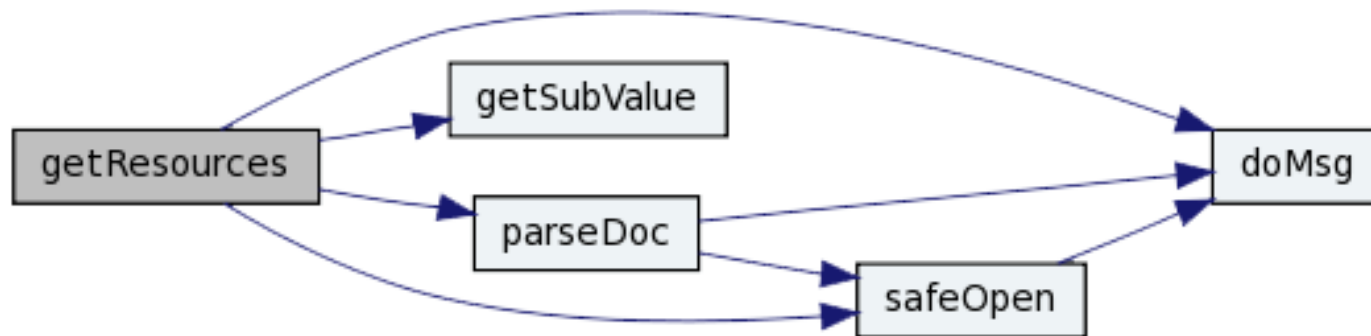
Doxygen - GraphViz

- File dependency graphs
- Clickable links



Doxygen – GraphViz (cont.)

- Functional dependency graphs
- Flow visualization
- Easy code debugging



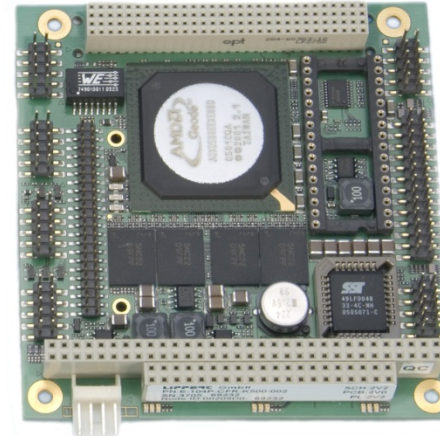
Platform Migration

- Three considered platforms:
 - VersaLogic EPM-5 “Puma”
 - Lippert “Cool FrontRunner”
 - eBox-2300 (“NorhTec MicroClient”)
- Puma and Lippert suspended due to time constraints

VersaLogic EPM-5 “Puma”



Lippert “Cool FrontRunner”



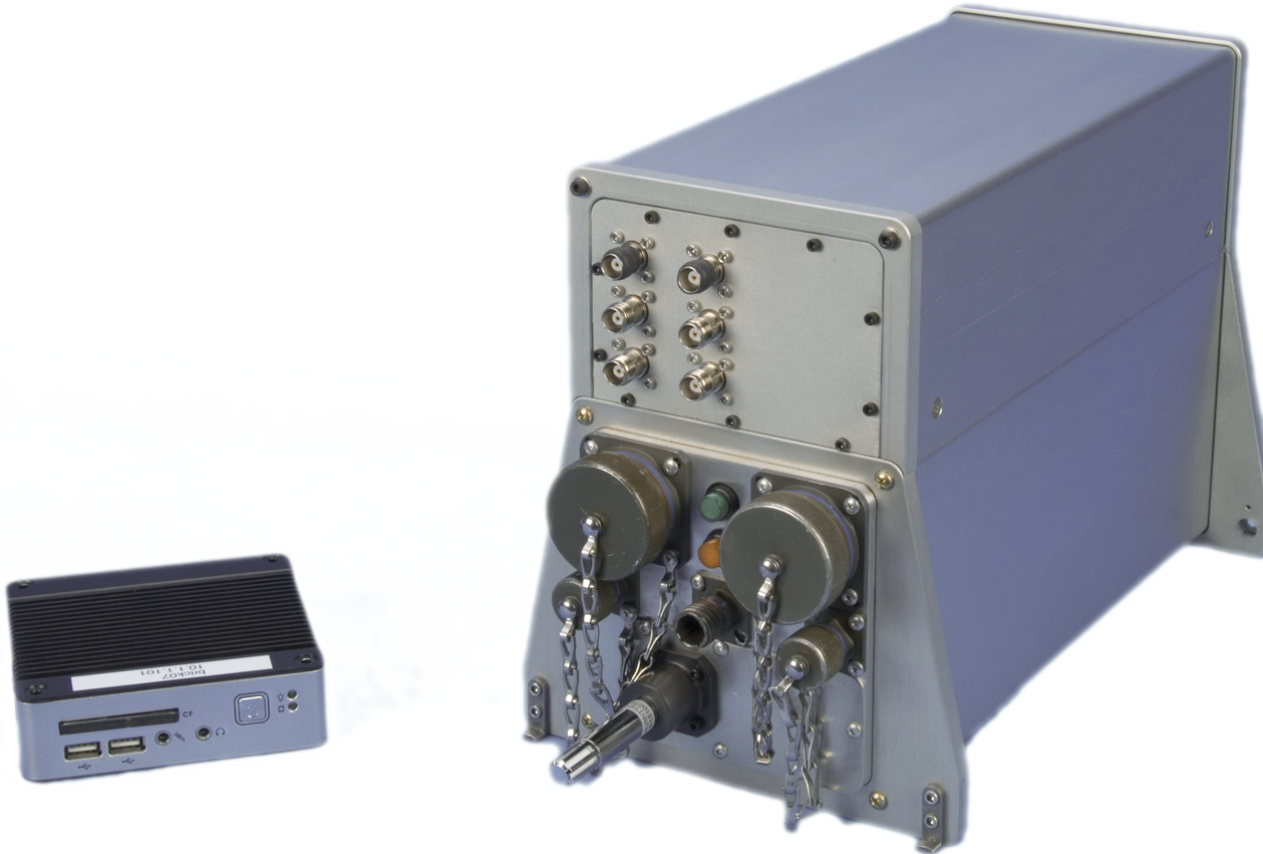
eBox-2300

- Motivations for choice
 - Built-in Compact Flash interface
 - Passive Cooling
 - Low Power Consumption (15W)
 - Self Contained
 - Two Serial Ports



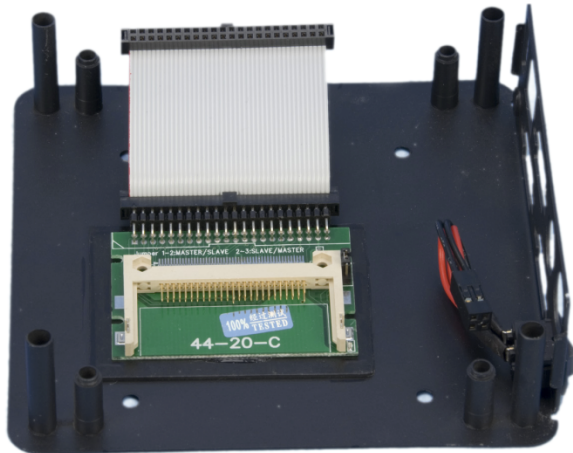
eBox-2300 (cont.)

- Finally: small size



eBox Modification

- Added 2nd Compact Flash interface
 - Usability: separates system and data
 - Makes one complete package



Testing REVEAL

- Data Source: Piccolo II Autopilot
 - Generates useful, verifiable data
 - Communicates over serial
 - Existing data acquisition software



Testing REVEAL (cont.)

- Network Link: Iridium 9505A Satellite Phone
 - Globally accessible
 - Allows data transmission
 - Serial accessory



Field Test

- Proof of Concept

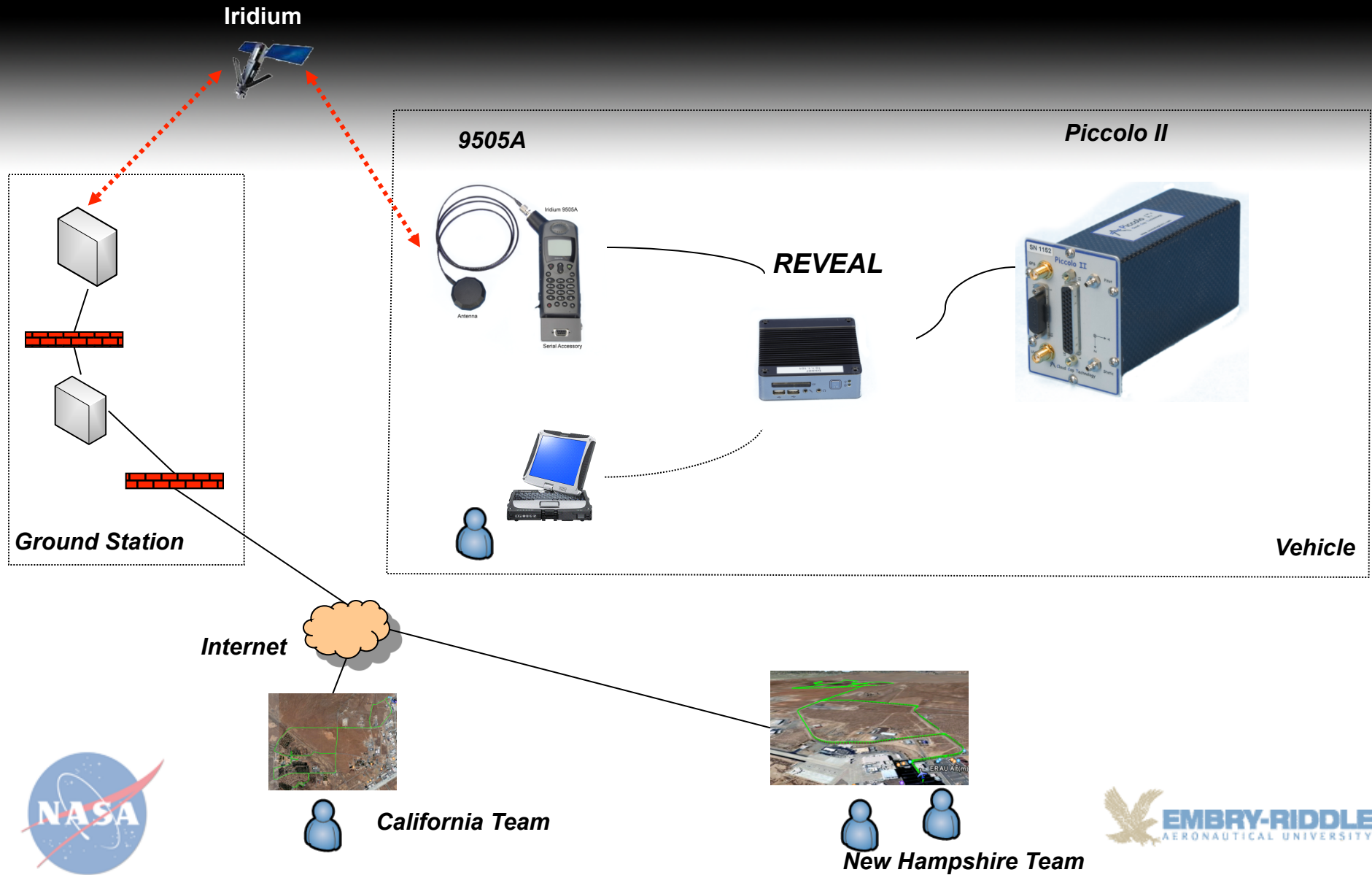
Truck Setup

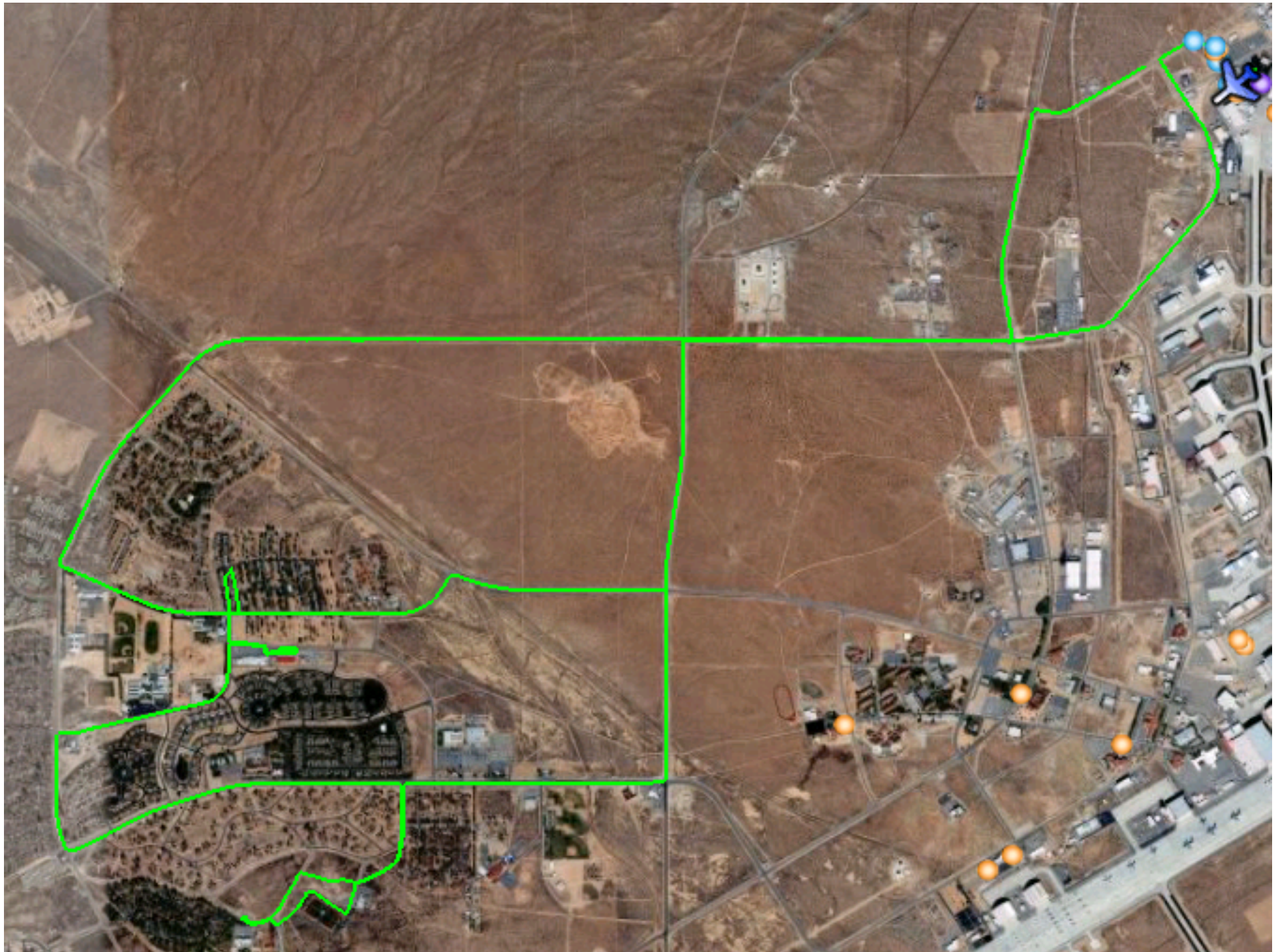


Terminal



Physical Network Architecture





Field Test (cont.)



Next Steps

- Further documentation
 - XML configuration files
 - Data flow
 - Accessibility to a broader audience
- Further miniaturization of REVEAL hardware
 - Current size is restrictive
- Expanded applications of REVEAL software



Project Status

- Implemented multi-developer capability for REVEAL
 - Created interactive REVEAL documentation.
- Became first users
- Migrated REVEAL to low-cost hardware (eBox-2300)
 - Field tested system
 - Verified end-to-end operation



Acknowledgments

- Larry Freudinger
- Brent Bieber
- Sky Yarbrough
- Jim Murray
- Shari Olson
- Miriam Rodon-Naveira
- Matt Miller & John Wilson
- Professor Gary Gear





Questions?

